

1999 Ground Water Protection in Virginia

Twelvth Annual Report of the Ground Water Protection Steering Committee

Rural Household Water Quality Education Program

To date, more than 8,500 households in 61 counties (see Table below) have participated in the program by collecting samples from their private, individual household water supplies and having them tested for general water chemistry and bacteriological contamination. This particular water quality testing and information program for rural households has been conducted in Virginia since 1989. The program's objectives are two-fold. First, through increasing awareness and under

Household Water, continued page 10

The Rural Household Water Quality Program has been conducted in the following counties:

1) Albemarle	16) Culpeper	31) King William	46) Prince George
2) Amelia	17) Dickenson	32) Lancaster	47) Prince William
3) Amherst	18) Dinwiddie	33) Lee	48) Pulaski
4) Appomattox	19) Essex	34) Loudon	49) Rappahannock
5) Bedford	20) Floyd	35) Louisa	50) Richmond
6) Bland	21) Fluvanna	36) Madison	51) Rockbridge
7) Botetourt	22) Franklin	37) Matthews	52) Russell
8) Buchanan	23) Giles	38) Middlesex	53) Scott
9) Buckingham	24) Gloucester	39) Montgomery	54) Southampton
10) Campbell	25) Goochland	40) Nelson	55) Spotsylvania
11) Caroline	26) Grayson	41) Northumberland	56) Stafford
12) Carroll	27) Greene	42) Orange	57) Tazewell
13) Chesterfield	28) Isle of Wight	43) Page	58) Warren
14) Clarke	29) King & Queen	44) Patrick	59) Westmorland
15) Cumberland	30) King George	45) Powhatan	60) Wise
			61) Wythe

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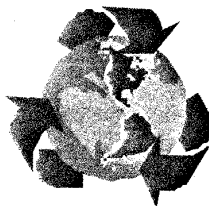
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I. PERSPECTIVE

Ground Water Protection Steering Committee 1999

The Ground Water Steering Committee had its usual busy year of presentations, discussions and planning. Meetings are held the third Tuesday of every other month, from 9 a.m. to 12 noon. They typically begin with an hour or so of updates from each agency member about programs, regulations, and legislation concerning ground water. Agency updates are followed by one or two presentations from agencies or other institutions concerning ground water issues. Guests are also offered an opportunity to share their views at each meeting.

The September meeting saw an update from frequent guest **Blake Ross** of Virginia Tech about the Rural Household Water Quality Education Program (see above for information about the program).

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II. ACTIVITIES AND SERVICES

1999 General Assembly

The Year of Solid Waste!

Solid waste was a major issue during the 1999 General Assembly! **SB (Senate Bill) 1201** and **HB (House Bill) 2555** will cap the solid waste disposal volumes of a landfill at 2,000 tons per day or actual 1998 volumes. The reasoning behind these bills was that Virginia's landfills will not last long enough if they are allowed to exceed that disposal rate, and then more landfills will need to be sited – not an easy task! However, if a landfill wishes to dispose of more than 2,000 tons per day, it can ask DEQ for a variance on an individual basis. This individual consideration is possible for both public and private landfills.

Hazardous Waste Banned

SB 1308 and **HB 2556** will ban barges carrying solid and hazardous waste on the Rappahanock, James and York Rivers. Such barges do not currently travel any other rivers. The principal concern of the General Assembly was about the safety of the barges, and that the containers themselves cannot be made odor and spill proof. There have been some incidents where leachate from barge containers has contaminated a river. In the future on other rivers, containers on barges cannot be stacked more than two high.

HB 2430 increases the specific provisions that are to be addressed in regulations currently being developed for the barging of solid waste. It adds municipal and industrial sludge to the list of items that cannot be barged, specifies that containers can be stacked only two high, and requires that the containers be physically attached to the barge.

Hauler Certification for Solid Waste

SB 1309 and **HB 2557** are the most far-reaching measures to deal with solid waste management. They will increase the siting, permitting and operational requirements for solid waste landfills, re-

quire haulers to certify that they are not carrying any unpermitted waste before a landfill can accept the load, and impose a regulatory program for trucks hauling solid waste.

Wetlands Protection

HB 2471 will increase ground water protection by prohibiting the siting of landfills adjacent to wetlands and by increasing the ground water monitoring requirements for existing landfills located near wetlands from twice a year to quarterly. This legislation also strengthens the ability of the Virginia Waste Management Board to impose unilateral penalties and enforcement actions for violations of their regulations. The legislation was prompted by concerns about two landfills sited near wetlands in the Dragon Run area. The Division of Waste Program Coordination central staff prepared guidance that will be used until the Solid Waste Management regulations are amended.

Tipping Fees To Help Closures

SB 865 and **HB 1748** establish a fund for landfill tipping fees of \$1-2 per ton, which will be used to give grants to localities to ensure proper closure of landfills owned by the locality, or for the proper closure of abandoned landfills. Localities can opt out of paying into this fund by establishing their own fund for the same purpose.

Waste Management Practices To Be Studied

Over the next year DEQ will be conducting a comprehensive study of solid waste management practices in the Commonwealth. The study, which is due to be completed December 1999, will assess the status of landfills in Virginia, including an analysis of the impact of **HB 1205** or non-subtitle D landfills. If a facility has not offered its intent to expand laterally by January 1999, it will be subject to a moratorium on new waste cells and on expanding laterally until July 2000. The moratorium does not pertain to facilities

that had filed their intent prior to January 1999, or had filed an actual application prior to January 1999. The number of facilities that are likely to be permitted outside of the moratorium number about a dozen or less; of these, most involve lateral expansions and not the addition of new waste cells.

Additional Solid Waste Staff

DEQ received funding for 19 new FTE's for the solid waste program as a whole. Staff will be allocated as follows: 10 compliance inspectors; 1 enforcement support; 2 ground water review; 2 guidance and regulation development; 3 solid waste permitting, corrective action, gas remediation; 1 waste minimization staff, as well as funding for an additional 10 FTE's from the tipping fees. Of the 19 FTE's, some will be used for compliance inspection and some will be used for monitoring, although final allocation has not yet been made.

Phosphorous To Be Included In Poultry Nutrient Management Plans

HB 1207 is a major new program for poultry waste management. DEQ must develop regulations by October 2000, and by October 2001 all poultry operations with more than 200 animal units (about 20,000 chickens or 15,000 turkeys) will have to be issued general permits by the Water Control Board. **HB 1207** originated from concerns that animal waste has been having an adverse impact on ground water, particularly in the Shenandoah Valley. The Bill also contemplates stricter controls of phosphorous; by October 2005 all operations will need nutrient management plans that specifically limit phosphorous. The legislation impacts 1309 poultry operations in 37 counties, with about two-thirds of those operations located in the Shenandoah Valley.

This will be a new program, not an expansion of an existing program, and the Water Division of DEQ will administer it. An Advisory Group has been established

by DEQ to develop regulations. A second Advisory Group is being established to work with integrators on developing plans required by the Bill to show how they will handle excess litter that cannot be spread on their farms. DCR is heading the study group to work with the integrators. DEQ has been given 1 FTE to help with implementation, and DCR was given 6 additional nutrient management specialists.

Best Management Practices (BMP) Cost-Share Program

The Virginia Agricultural Best Management Practice (BMP) Cost-Share Program offers cost-share assistance for a wide range of agricultural BMPs that address water quality. The state provides Soil and Water Conservation Districts with funds to target areas with known water quality problems. The cost-share program's practices can often be funded by a combination of state and federal funds, reducing the landowner's expense to less than 30 percent of the total cost.

Many BMPs can make a significant impact on ground water quality. BMPs such as grazing land protection, filter strips and permanent vegetative cover on critical areas often have ground water benefits, particularly when installed in karst areas of the Commonwealth.

Under the 1998 BMP Cost-Share Program, landowners and producers installed 1151 BMPs with cost-share assistance.

There were approximately 2600 acres of cover crops planted with the assistance of the Program.

For more information contact the Department of Conservation and Recreation at 804-786-2064.



Virginia Nonpoint Source Management Program

In a kick-off meeting held last January, the Secretary of Natural Resources, John Paul Woodley, Jr. invited a wide range of groups and organizations to get involved in updating the Virginia Nonpoint Source Management Program. To facilitate and guide the program update process, work groups were formed for each contributor to nonpoint source pollution. Participation in these work groups included business and environmental interest groups, state agencies, planning district commissions, and other interested parties. Department of Conservation and Recreation staff led these work groups with considerable assistance from other state agencies.

Through the work group process, existing nonpoint source pollution control programs were identified and assessed, nonpoint source pollution issues were identified, and opportunities for improving nonpoint source pollution control were identified. The management program will address ground water management in the context of each contributor to nonpoint source pollution. The management program will also include a strong focus on watershed management and habitat and resource protection.

A draft management program document will be submitted to the Environmental Protection Agency (EPA) for review and approval and made available for public review in late summer or early fall. When finalized, the management program document will serve as a plan for guiding state nonpoint source pollution control actions for the ensuing five years and beyond. An updated and approved program will also help ensure that Virginia receives maximum program funding from EPA. An additional two million dollars in Clean Water Act, Section 319 funding will likely be available once the program update is approved by EPA.

Questions regarding the management program should be directed to **Rick Hill** with the Department of Conservation and Recreation at **(804) 786-7119**. For additional information visit the DCR Home Page at http://www.state.va.us/~dcr/dcr_home.htm.

Funding for the Virginia Ground Water Protection Steering Committee activities, including development of this Report, is provided through a grant to the Department of Environmental Quality by the US Environmental Protection Agency

• Virginia On-Line

The state's "world wide web" home page is accessible via the Internet and provides information about a growing range of state agencies and programs. Virginia web address is:

<http://www.state.va.us/>

• Spread the Word

Do you know of an individual or organization who would benefit from receiving a copy of this and future Annual Ground Water Reports?

Call **Mary Ann Massie at (804) 698-4042** to add names to the mailing list.

Water Wizard Education Van

Theme – Learning and Caring about Virginia's Waters.

Goal – To empower youth and families to take care of water.

Objective – To teach youth and families that their actions affect water quality.

Water is a limiting resource and is of primary importance for all aspects of life. Many people take their drinking water and natural water resources for granted. Maintaining a high quality of life, in part, means having an adequate supply of clean water for personal use and in the environment. Therefore, teaching people how to protect and conserve their water re-state and national organizations and sources is a major goal of many local, agencies.

For this purpose, the Virginia office of the Natural Resource and Conservation Service (NRCS) has dedicated a cargo van to the Virginia 4-H Program that will serve as a traveling water resource education vehicle. A partnership of fifteen agencies and organizations came together to plan, equip and develop program materials for the *Water Wizard Van*. The van is designed to operate as a stand-alone, interactive, educational exhibit that can be used at any public event or gathering. Exhibits consist of light boards, games, puppets, and testing kits. The van will be housed and operated at Virginia's six 4-H Educational Centers on a rotating basis. It will be available for off-Center use through arrangements made with local 4-H Extension Agents and the 4-H Centers.

Through grant funding, the van has been outfitted with a multitude of educational tools, kits, displays, equipment, supplies, and other educational resources that can be used by youth program leaders, school teachers, and others for the purpose of conducting educational programs on water quality. The van addresses a number of educational concepts including the water cycle, watersheds, water use, water quality factors, best management practices, groundwater, aquatic wildlife, biological monitoring and water stewardship.

It is anticipated that over 12,000 4-H and other youth will have access annually to the water quality educational resources the *Water Wizard Van* has to offer. Its highest use will occur during the summer camp season. However, requests



for off-Center use such as youth field days, school programs and special events are high. Because the van is mobile, the educational programs can be custom fit on a watershed basis for different localities throughout the state. Youth and families who are exposed to the water quality educational programs associated with the van will have the opportunity to become better stewards of Virginia's water resources.

For more information about the van or how to schedule its use for your event call your local Cooperative Extension Service office or visit the website <http://www.ext.vt.edu/resources/4h/wizard/index.html>

Sponsoring agencies & organizations

*Natural Resource Conservation Service
Virginia Cooperative Extension – VA State and
VA Tech Universities
Virginia Coastal Zone Program - NOAA
Virginia Department of Environmental Quality
Virginia Department of Conservation and
Recreation
Virginia Department of Game and Inland
Fisheries
Virginia Department of Forestry
Virginia Department of Education
Virginia Association of Soil and Water
Conservation Districts
U.S. Environmental Protection Agency
with assistance from the
Mathematics and Science Center
Institute for Chesapeake Bay Studies
Alliance for the Chesapeake Bay
Chesapeake Bay Foundation, and the
Virginia Farm Bureau*

Water Education for Teachers' Activities

Ann Regn and Kelly Heimbach, DEQ Environmental Education Coordinators, conducted a Ground Water Education for Teachers (W.E.T.) facilitator training course in April 1999. These sessions have become very popular and fill well in advance of registration deadlines. W.E.T. training is for anyone interested in environmental issues with a commitment to conducting future workshops. The ground water sessions have been conducted free of charge and include overnight accommodations, meals, classroom instruction, materials and the W.E.T. curriculum guide - not to mention excellent "networking"

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Children's Ground Water Festival Planned

The idea of a ground water festival for children originated with the Nebraska Groundwater Foundation in 1989. Since that time, many festivals have been organized to educate children about all aspects of ground water and its relationship to numerous other resources. **The Virginia Ground Water Protection Steering Committee, DEQ Environmental Education Coordinators, and Shenandoah Pure Water 2000 Forum** will team up to conduct a Children's Ground Water Festival in Spring 2000. Three hundred sixth grade students from Rockingham County schools will be invited to attend the event. Funding will be provided through DEQ's Ground Water Protection Grant from EPA. For more information, contact **Mary Ann Massie** at DEQ 804-698-4042 or email mamassie@deq.state.va.us.

Virginia Rural Water Association Update

VRWA is helping the Counties of Page, Shenandoah, Lunenburg, and Charlotte to establish and implement viable source water protection plans. Two VRWA programs are involved in these efforts, the Ground Water Technician (Ken Coffman) and the Source Water Technician (Steve Childers). Three of these four Counties have both surface water and ground water sources for their drinking water supplies.

The technical assistance rendered to these localities is predicated toward the concept of them assuming "ownership" and responsibility for the plans developed. The establishment of "partnerships" between the Counties, Towns, other public water supplies, State agencies, and assisting entities such as VRWA is stressed in the development of these plans. Making use of the data, information, and sample plans available to the localities is a major part of these efforts.

VRWA currently devotes approximately 30% of its resources to the protection of public drinking water sources and supplies.

For more information about these activities:

Ken Coffman-Ground Water Technician

E-Mail: kcoffman42@mindspring.com

Steve Childers-Source Water Technician

E-Mail: schilders62@yahoo.com

VRWA has been on the web since September 1998. The web site is updated daily by our in-house staff. The site now includes an updated calendar that lists all current and scheduled future training being conducted by VRWA. Check them out to learn more about the Association and the services provided.

To contact VRWA, phone:

Rick Brown, Exec. Dir. 540/261-7178.

E-mail: cmdrbrown@rockbridge.net

Web: www.nrwa.org/vrwa

The basic mission of VRWA is to provide classroom and on-site training opportunities to water and wastewater utilities statewide. Knowledgeable staff mem-

bers with years of experience in their fields provide on-site technical assistance. The Association recently added a Wastewater Training Technician (BJ Blessing) to better serve its members and others

WATER EDUCATION For Teachers

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opportunities. Funding is provided through DEQ's Ground Water Protection Grant and DEQ's Coastal Zone Grant, both from EPA. Carol Zokaite, from Project Underground, and Terri Brown, from DCR's Karst Project, assisted Ms. Regn and Ms. Heimbach by leading sessions and a field rip to Grand Caverns in Grottoes, Virginia.

Activities for the Year 2000 include a Facilitators' "Update" for former W.E.T. graduates to get back together for additional classroom instruction and information exchange. W.E.T. facilitators should contact **Ann Regn** at 804-698-4442 or email amregn@deq.state.va.us for more details.

The Ground Water Protection Steering Committee Meeting is held the third Tuesday of every other month

(January—March—May—July—September—November)

Feel Free to Attend—

Meetings are normally held at the Dept. of Environmental Quality, 629 E. Main St., Richmond, from 9 a.m. to noon.

For more information, contact
Mary Ann Massie, DEQ, at 804-698-4042

Virginia Agricultural Stewardship Act

Background and Overview

The Agricultural Stewardship Act (ASA) is the result of a joint effort by Virginia's agricultural and environmental communities, the Association of Soil and Water Conservation Districts and state agencies to develop a common-sense solution to water pollution problems caused by agricultural operations. The goal of the Act is to consider the needs of the farmer while meeting the requirements of environmental protection.

The Virginia General Assembly passed the law in 1996, and when the Ag Stewardship program went into effect on April 1, 1997, it represented a very innovative approach to environmental issues.

How the Program Works

Complaints alleging that a specific agricultural activity is causing or will cause water pollution go to the Commissioner of the Virginia Department of Agriculture and Consumer Services. If a complaint meets the criteria for investigation, the Commissioner's Office contacts the appropriate Soil and Water Conservation District about investigating the problem. If the district declines, the Commissioner's Office conducts the investigation.

The purpose of the investigation is to determine whether the agricultural activity is causing or will cause water pollution. If no causal link is found, the Commissioner will dismiss the complaint. If the investigation determines that the activity is the cause, the farmer is given sixty days to develop a corrective plan. The local District then reviews the plan and when it meets the necessary requirements to solve the water pollution problem, the Commissioner approves it.

From the time the Commissioner determines that a complaint is founded, the Act gives the farmer six months to start implementing his plan and eighteen months for full implementation. The timing allows the farmer to take advantage of suitable weather conditions for any outside work or construction required. If

Program Objectives

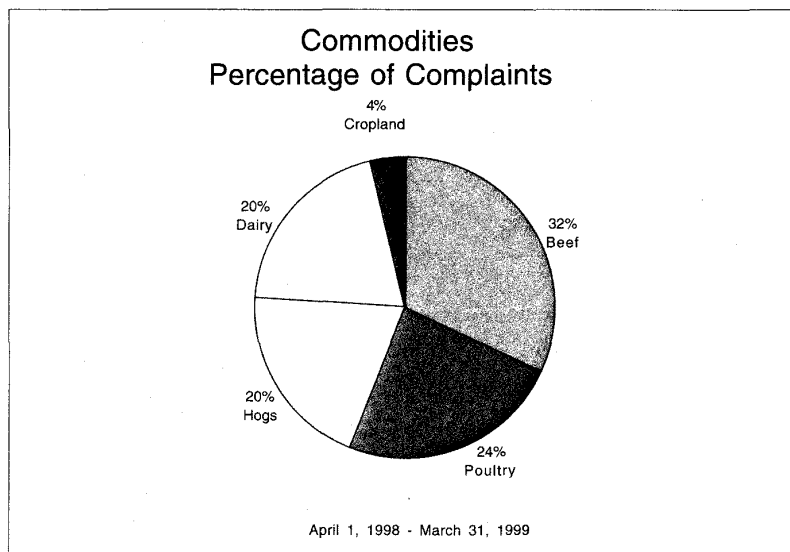
- To identify real water quality problems and to help farmers correct them in a common-sense manner that accommodates both the farm and the environment;
- To establish a system that respects both the farmer and the person voicing concern about water quality;
- To educate farmers about stewardship and to encourage them to enhance it even in instances in which a water quality problem cannot be proven in a legal sense;
- To support farmers in their efforts to strengthen their stewardship practices, to provide them with the information they need, and to help link them to resources that can provide assistance;
- To educate the average citizen about normal farming practices that are not harmful to water quality regardless of their appearance; and
- To provide Soil and Water Conservation Districts with training and the ASA materials needed, to the extent that resources will allow.

Explanation of Complaints: April 1, 1998 – March 31, 1999

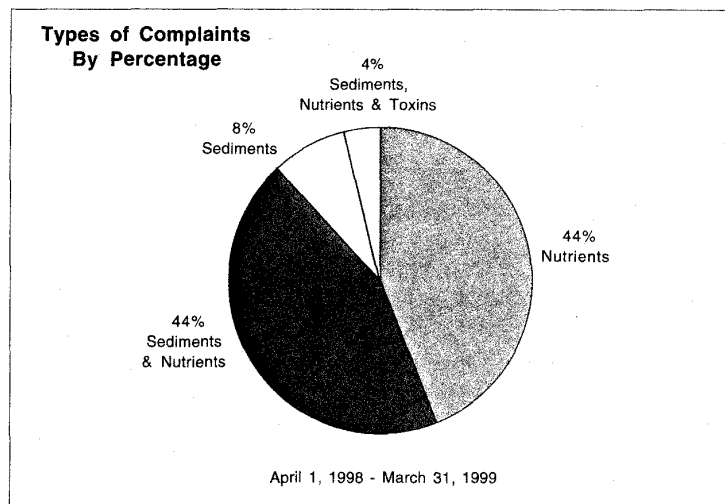
In the second year of the Ag Stewardship program, the Commissioner received 25 official complaints. Five commodity groups were the subject of this year's complaints: beef – 8; poultry operations – 6; dairy – 5; hogs – 5; cropland – 1.

The Agricultural Stewardship Act addresses water pollution problems caused by nutrients, sediments and toxins entering state waters from agricultural activities. Eleven of the complaints involved both sediments and nutrients. Another eleven complaints attributed the pollution problems solely to nutrients, while two faulted only sediments, and one cited the combination of sediments, nutrients and toxins. Twenty of these complaints concerned surface water issues, one concerned ground water, and three involved both ground and surface water.

The Commissioner's Office, together with local Districts in many cases, completed investigations in all 25 complaints. The investigations determined that 16 of the complaints revealed insufficient or no evidence of water pollution; therefore, these complaints were unfounded. In some of these



a farmer fails to implement a plan within cases, no clear connection could be made between the alleged pollution and the body of water in question. In other cases, the alleged problem had been corrected by the time the investigation was completed. In



this law has triggered a new awareness of the water quality problems agricultural operations can generate and the need for prevention and resolution. The effect of the law has proved greater than a summary of its provisions would indicate. Farmers have sought information and assistance; the Agricultural Stewardship staff and Soil and Water Conservation District representatives have provided education and advice. Both agriculture and the environment have been the beneficiaries.

The Agricultural Stewardship Act relies on the good faith and intentions of those it governs. Farmers care about our land and water because these resources provide the basis of their livelihoods, so a system created to consider the needs of both the farmer and the environment makes good sense and good environmental policy.

To ensure that the level of knowledge and service remains high, the staff of the Agricultural Stewardship Program will continue to provide opportunities for education and instruction for the many partners involved in this ongoing conservation effort. As a follow-up to last year's training, the sessions will provide updated information, address an expanded list of topics and examine emerging issues.

For further information, contact the Program at 804-786-3538.

some instances, the farmers involved in unfounded complaints voluntarily incorporated best management practices into their operations to prevent more complaints or to prevent potential problems from developing into founded complaints.

In five of the investigations, there was sufficient evidence to support the allegations that the agricultural activities were causing or would cause water pollution. These cases were determined to be founded. Four of the farmers with founded complaints submitted plans which were reviewed by the local Soil and Water Conservation District and approved by the Commissioner. Three other complaints were dismissed by the Commissioner and one still awaited a decision by the Commissioner.

Farmers involved in the complaint and correction process were very cooperative in meeting the deadlines set by the Agricultural Stewardship Act and it was not necessary to assess any civil penalties.

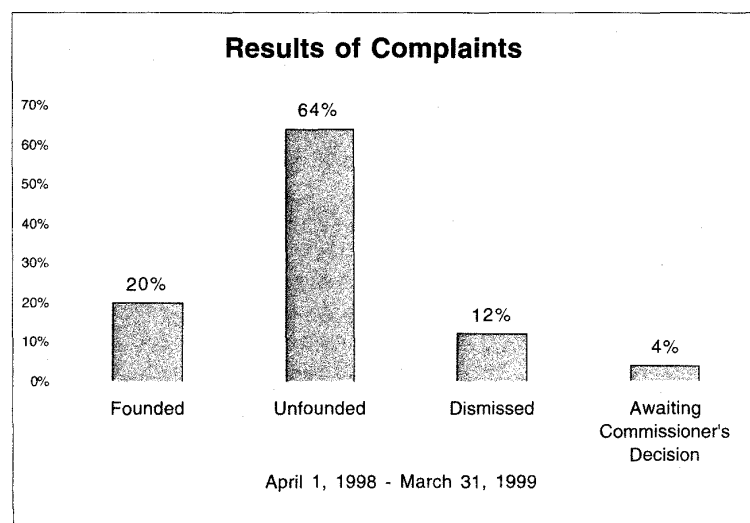
At the time of last year's *Annual Report*, two complaints from the previous years were still under investigation and nineteen founded complaints were still active. Both investigations involved operations in Tazewell and both were determined to be unfounded. Of the founded complaints that were still active, the results as of March 31, 1999, are as follows: 9 were com-

pleted, 1 received an extension, 8 were awaiting completion and one had been forwarded to the Attorney General's Office for enforcement action.

Conclusion

The two years of the Agricultural Stewardship program provide clear evidence that its common-sense approach to water pollution is an effective way to solve a challenging problem. This program recognizes that although clean water is the goal, there is more than one way to achieve it. Even as each complaint arises from a different set of circumstances, each solution will also be unique.

Although a complaint triggers the actual provisions of the Act, the mere existence of



Effects of Ground Water on Stream-Water Quality in Polecat Creek

Introduction

The Chesapeake Bay Local Assistance Department (CBLAD) is interested in determining the effectiveness of the Chesapeake Bay Preservation Act (the Act) in reducing the amount of nutrients discharged to Chesapeake Bay from areas having different land uses. Implementation of best management practices (BMP's) is a primary method for reducing nutrients under the Act. The Polecat Creek watershed, a watershed undergoing changes in land use with the implementation of BMP's, was selected as an example watershed to be used in evaluating the effectiveness of the Act (fig. 1). CBLAD has been monitoring stream flow, stream-water quality, stream biota, land use, and weather in the watershed with the assistance of the Virginia Department of Environmental Quality, Virginia Common-

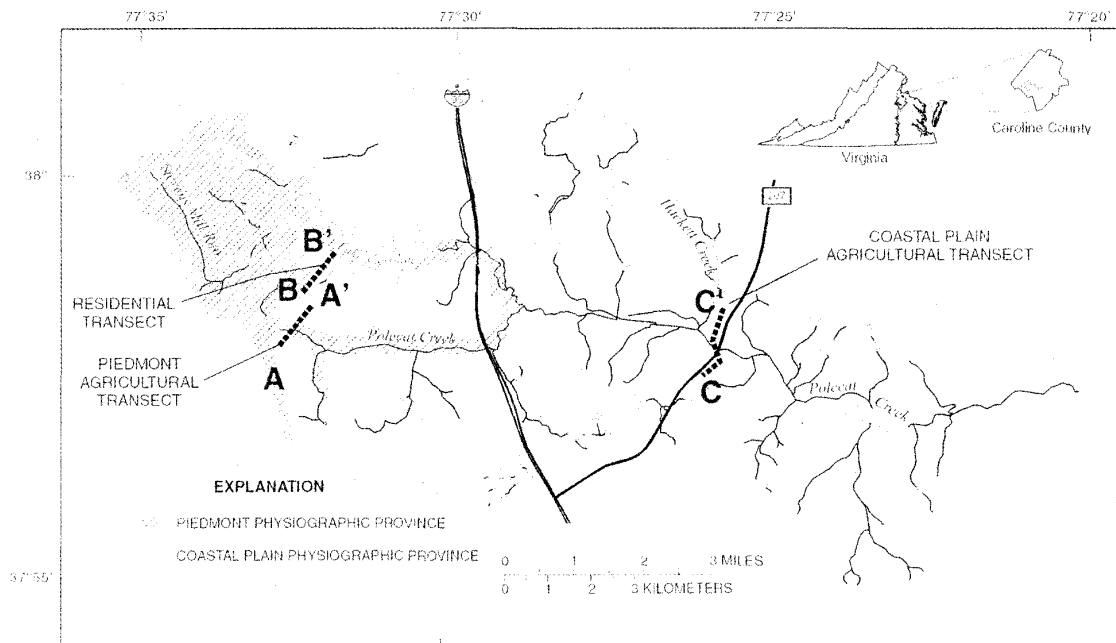
wealth University, and Virginia Polytechnic and State University as a part of a 10-year study initiated in 1993. In addition to long-term monitoring, an understanding of processes that control the fate and transport of nutrients in the watershed is essential to evaluating causes of future changes in stream-water quality and the effectiveness of the Act.

In 1997, the U.S. Geological Survey (USGS) began assisting CBLAD by evaluating the transport of nutrients through the ground water systems of the watershed. Studies have shown that ground water discharge contributes from 50 to 80 percent of the flow in streams throughout Virginia (Richardson, 1994; Nelms and others, 1997). Ground water, therefore, can be a major pathway for the transport of nutrients and other contaminants from the land surface to streams. A combination of land use with BMP's and the hydrologic and chemical characteristics of aquifers through which the ground water flows affects ground water quality and nutrient transport to streams. Thus, an evaluation of the flow and chemical processes that affect the quality of ground water is essential to evaluating the effects of the implementation of the Act on stream-water quality.

Another important aspect of evaluating the effectiveness of the Act is the time it takes water and nutrients to flow through an aquifer (ground water age). Water and contaminants can remain in an aquifer for decades. Consequently, the full effects of changes in land use and implementation of BMP's can take decades to be observed in stream-water quality. Such delays could cause nutrient concentrations in stream water to increase or decrease more slowly than expected after BMP's are implemented.

Methods

The USGS study of ground water in the Polecat Creek watershed includes (1) quarterly monitoring of nutrient concentrations in the ground water, (2) monitoring of ground water levels, (3) determination of the age of the ground water, (4) periodic determination of major ion concentrations and other aspects of the water quality, and (5) an evaluation of ground water sources and flow paths and processes in the aquifer systems that affect stream-water quality. To evaluate the effects of ground water on stream-water quality, clusters of wells and individual wells have been installed in transects located along



regional ground water flow paths in different land uses and different hydrologic and chemical environments. One agricultural transect (the Piedmont agricultural transect (A-A' on fig. 1) is located in the upper part of the watershed where Piedmont rocks overlain by Coastal Plain sediment form the aquifer system. A second agricultural transect (the Coastal Plain agricultural transect (C-C' on fig. 1)) is located in the lower part of the watershed where Coastal Plain sediment forms the aquifer system. A transect in a low-density residential area (B-B' on fig. 1) is located in the Lake Caroline subdivision where a combination of Piedmont rocks and Coastal Plain sediment also form the aquifer system. Wells located (1) along regional flow paths in other land uses and (2) along local flow paths in areas where flow and chemical processes likely alter the water chemistry will supplement wells initially installed for the study.

Results

Nutrient concentrations in the ground water varied depending on land use and location of the well in the ground-water flow system of the Polecat Creek Watershed. In general, nitrate is the dominant nutrient transported by ground water. Nitrogen species are commonly oxidized to nitrate (which is soluble in water) in ground water while phosphorus (largely consisting of orthophosphorus) tends to adsorb to fine-grained aquifer material and is not readily transported through the ground-water system. Nitrate concentrations in the Polecat Creek watershed ranged from less than 0.005 to 24.8 mg/L as nitrogen (N). In contrast, ammonia concentrations generally were less than 0.1 mg/L as N and phosphorus concentrations generally were less than 0.03 mg/L as phosphorus.

In the low-density, residential transect, nutrient concentrations near the water table were extremely variable. Nitrate concentrations near the water table ranged from less than 0.005 to 0.88 mg/L as N. Ammonia concentrations near the water table ranged from less than 0.002 to 15.5 mg/L as N.

In the Coastal Plain agricultural transect, nitrate concentrations were as great as 24.8 mg/L as N in recently recharged water beneath upland agricultural fields but less than 0.5 mg/L as N in water recharged beneath upland woodlands. In the Piedmont agricultural transect, nitrate concentrations beneath the agricultural fields were greatest near the water table and decreased with depth as the ground water increased in age and was less affected by likely recent increases in nutrient input. On the north side of the creek, for example, nitrate concentrations decreased from 3.9 mg/L as N near the water table where water was recently recharged to about 0.25 mg/L as N 25 to 30 feet beneath the water table where water was about 30 years old and the median dissolved oxygen concentration was 3.7 mg/L.

Conclusions

Preliminary results indicate that ground-water discharge pathways and mechanisms potentially can affect nutrient concentrations in the streams. During periods of high ground-water levels when stream base flows are high, recently recharged ground water flows along short, shallow flow paths and discharges through upland ditches, seeps, and springs. During periods of low ground-water levels when stream base flows are low, stream flow is largely old ground water that flows along long and deep flow paths and discharges diffusely through the streambed or as seeps in the stream bank. Consequently, stream-water quality will be affected significantly by differences in (1) the age of the ground water, (2) land-use practices at the time the water was recharged, and (3) chemical changes as the ground water flows along different flow paths. Evaluation of the effects of ground water on stream-water quality is providing important information for the evaluation of the effectiveness of the Chesapeake Bay Preservation Act in the Polecat Creek and other watersheds throughout the Chesapeake Bay watershed.

References

Nelms, D.L., Harlow, G.E., and Hayes, D.C., 1997, *Base-flow characteristics of streams in the Valley and Ridge, Blue Ridge, and Piedmont Physiographic Provinces of Virginia*: U.S. Geological Survey, Water-Supply Paper 2457.

Richardson, D.L., 1994, *Ground-water Discharge from the Coastal Plain of Virginia*: U.S. Geological Survey, Water-Resources Investigations Report 93-4191.

For more information, contact **Gary Speiran** of the USGS at 804-261-2642; Email gspeiran@usgs.gov or **Ram Gupta** of CBLAD at 804-692-0429; Email RGupta@cblad.state.va.us.



**Water quality
preservation is
everyone's concern.**

**If you suspect a
pollution incident
has occurred, please
call:**

**Department of
Emergency Services**

**1-804-674-2400
24-hour hotline**

Rural Household Water

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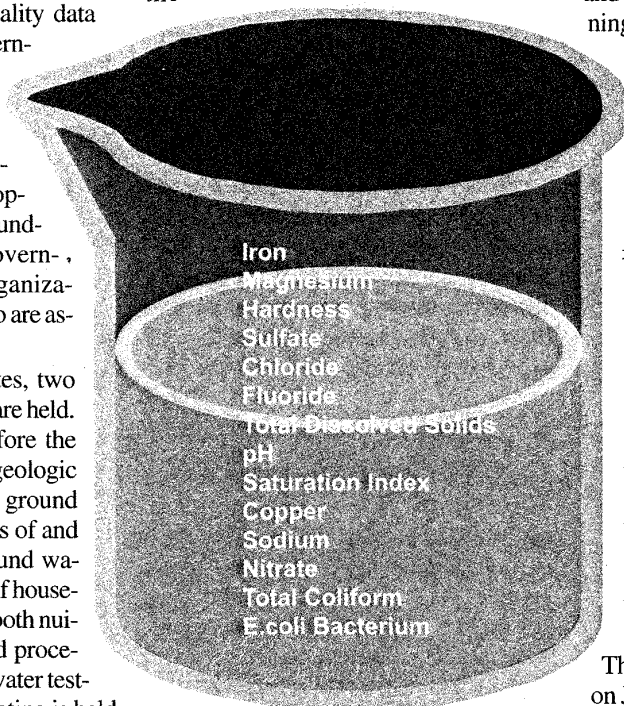
standing of water quality problems, protection strategies and treatment alternatives, the quality of life of rural homeowners and the health of the general environment can be improved, and secondly, a ground water quality data inventory to assist local governments in land use and ground water management decisions is being created. The program is run on the local level through Virginia Cooperative Extension Offices. Funding is provided by local governments, agencies, citizen organizations, and the participants, who are assessed a minimal testing fee.

When a county participates, two county-wide public meetings are held. The first meeting is held before the testing to explain local hydrogeologic characteristics in relation to ground water pollution, likely sources of and activities contributing to ground water contamination, the nature of household water quality problems (both nuisance and health related), and procedures for participation in the water testing program. The second meeting is held after the testing to disseminate and discuss test results with participants and to suggest management practices that might be implemented to reduce or to prevent water contamination.

County residents can obtain two types of water sample testing kits, 1) a general water chemistry analysis for iron, magnesium, hardness, sulfate, chloride, fluoride, total dissolved solids, pH, saturation index, copper, sodium and nitrate; and 2) microbiological testing for total coliform and E. coli bacteria. In addition to the test results, other information is collected about each sample, such as the type of water source, water source environs, proximity to contaminant sources, and treatment devices.

On the basis of this information and the results of the general water testing program, additional samples from a limited

number of "high-risk" households are selected for testing of various chemical compounds in some counties. Following the second public meeting, participants receive an evaluation survey in the mail. Respondents to these surveys have indicated that the primary reason for their participation in the program was concern about the



safety of their water supply. They also indicated that the program increased their understanding of water quality. More than two-thirds of the households that reported having at least one water quality problem had taken or planned to take at least one measure to improve the quality of their water supply. Actions included shock chlorinating the system, conducting a follow-up water analysis, or seeking state agency assistance in correcting the problems.

The most widespread problem identified across Virginia is bacteriological contamination, mostly total coliform but also some E. coli. Analysis for pesticides and other chemical compounds revealed little evidence of such contamination, even though "high-risk" supplies were targeted in many cases.

Throughout the course of the programs, local government and public officials were informed of the water quality results. All water quality test results along with pertinent water supply characteristics were entered into a computer database, without identifying the individuals or property, to be used for further analysis, for mapping, and for future county and regional planning. Summary reports are available for most of the counties listed on page 1.

For additional information, contact **Blake Ross** of Virginia Cooperative Extension at 540-231-4702.

Virginia's Source Water Assessment Program - Update

In the 1998 *Annual Report*, the Virginia Department of Health (VDH) described the Environmental Protection Agency's (EPA's) requirements for a State's Source Water Assessment Program (SWAP). Also described were the process/procedures that VDH would use in developing the SWAP. The draft SWAP was submitted to EPA on January 21, 1999, and final comments from EPA have not been received. It is expected that final approval will be received by the time of publication, and future annual reports will include updates on the SWAP.

An activity incidental to the SWAP is the accurate location of all ground water and surface water sources utilized by Virginia's public waterworks. VDH has procured state-of-the-art Global Positioning System (GPS) equipment and has begun the process of source locations. In order to use this data for preparing maps required by the SWAP, VDH is in the process of analyzing available Geographic Information System (GIS) databases. VDH's intent is to work with and through other State, Federal and local agencies to develop GIS layers appropriate to the SWAP. Any databases developed by VDH will be made available to other agencies.

Virginia Coastal Plain Model to be Revised

Plans are moving ahead to undertake a comprehensive revision of a computer model of Virginia's Coastal Plain aquifers (see the article in the 1998 *Annual Report's* "Computer Model Aids Management of Ground Water Resources in Eastern Virginia"). Working in cooperation with the Virginia Department of Environmental Quality (DEQ) and other State and local agencies, the U.S. Geological Survey (USGS) is laying the foundation to revise the ground water flow model it developed of the eastern part of Virginia that lies in the Coastal Plain province.

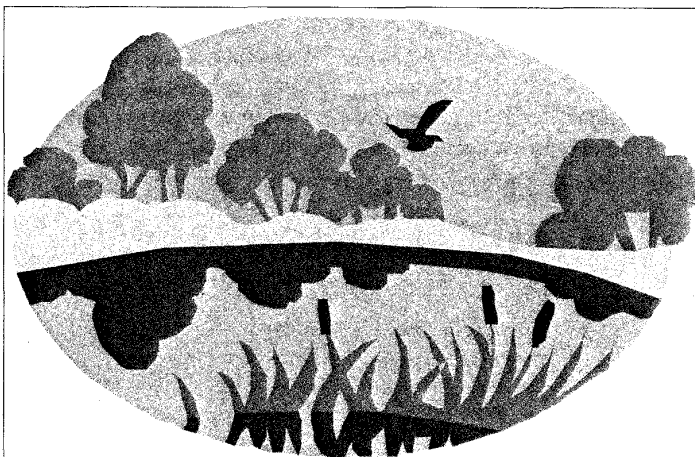
Large ground water withdrawals in the Virginia Coastal Plain during the past several decades have led to declining ground water levels, as deep as 160 feet below sea level near major pumping centers. Further declines could increase the cost of water-supply development and threaten the sustainability of the resource. In addition, the Coastal Plain aquifers make up a complex and interconnected hydrologic system; large ground water withdrawals can have wide-ranging effects that cross city, county, and even state boundaries. The Virginia Coastal Plain model was first constructed in the early 1980's, as part of the USGS nation-wide Regional Aquifer System Analysis (RASA) program, to help scientists better understand how the ground water flow system operates and how it is influenced by withdrawals. Using a computer program and related data sets that simulate ground water flow, the model allows large amounts of data to be synthesized to test ideas about how the flow system works. Accordingly, DEQ has used the model as an efficient and scientifically sound means to evaluate the combined effect of numerous actual and proposed withdrawals. Thus, the Virginia

Coastal Plain model has significantly enhanced the state's ability to manage this important water resource and to ensure that the aquifers continue to provide a reliable, long-term water supply.

Adequate maintenance is essential for the model to remain viable as a resource management tool. During the nearly two decades since the model's inception, both the stresses imposed on, and the scientific understanding of, the Coastal Plain aquifers have evolved significantly. Gaps in withdrawal data used for model simulations have grown, and an increasing number of withdrawals are being located near model boundaries, where the model is least accurate, or even beyond the boundaries in salty parts of some aquifers in Virginia and in rapidly developing areas outside of Virginia. Many geological relations

original model design need to be reevaluated and remaining uncertainties quantified. More detailed effects of withdrawals, including possible effects of withdrawals on streamflow and water quality, also need to be represented.

The Virginia Coastal Plain model is now in need of comprehensive revision to address increasing stresses from ground water withdrawals and to enable simulations to represent more realistically and accurately ground water conditions. In order to adequately address the large scope and technical complexity of work needed to revise the model, the USGS convened a 3-day workshop during April 1999 that was attended by representatives of DEQ and other agencies and USGS hydrologists and geologists from across the nation. Topics of discussion included model capabilities required for ground water management, problems arising from current use of the model, possible improvements for continued model use, and considerations for planning revisions to the model. The broad breadth of expertise represented at the workshop produced a rich array of information. Subsequently, a 5-year plan of study was formulated to describe and appropriately sequence project tasks and to identify required staffing and other



are also being established that contrast greatly with those used to first construct the model, including a recently discovered, approximately 60-mile-wide crater that formed when a comet or meteorite struck the Earth about 35 million years ago near the mouth of the present-day Chesapeake Bay. Hence, the geometric configuration and hydraulic properties of the aquifers and interpretation of water levels measured in them are now significantly in doubt. In addition, ongoing demands for effective ground water management require improvements in simulation performance and capabilities. Various assumptions and limitations inherent in the

resources, thereby providing a guide to implement model revision and related activities. Additional planning efforts are being targeted toward beginning the project by the year 2000.

The Virginia Coastal Plain ground water model will be revised to address increasing demands on the resource, incorporate the most up-to-date knowledge of ground water conditions, and improve simulation performance and capabilities. With the revised model, the Commonwealth will continue to have an efficient and scientifically sound means to evaluate and manage this large, complex, and intensely used resource.

Steering Committee

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During the **November** meeting, Steering Committee members and meeting guests spent the morning touring the new Library of Virginia. The Library, which opened in December 1996, has over one million books and 83 million documents in archives. Virginia agencies are required to send copies of every report they issue to the Library. The Virginia Authors Room has most of the books written by Virginia authors since 1950.

In **January**, **Alan Weber** from the Department of Health described the considerable outreach effort the Department made to conduct its Source Water Assessment Program (SWAP – see page 10). **Rick Hill** from the Department of Conservation and Recreation described an ambitious effort to update the State's Nonpoint Source Management program (page 3). And **Terry Wagner** of the Department of Environmental Quality offered an update about the Ground Water Management Program, where new regulations took effect on January 1, 1999.

In **March**, discussion of new legislation passed by the 1999 General Assembly occupied the entire meeting. A considerable amount of that new legislation involved solid waste (see page 2 for a summary of new legislation).

The **May** meeting brought three more updates of agency programs. **Don Alexander** of the Department of Health updated two septic regulations, **Richard Ayers** of the Department of Environmental Quality described the development of poultry waste regulations, and **Charlie Lunsford** of the Department of Conservation and Recreation brought the latest news from the Nonpoint Source Management Program update.

The **July** Steering Committee meeting brought back **Mr. Alexander** to describe the Authorized On Site Soil Evaluator (AOSE) regulations being developed.

Of course, these formal presentations do not comprise all of the Steering Committee activities and discussions. Other issues discussed during the year included

the gasoline additive MTBE that is increasingly found in public and private wells, monitoring requirements for landfills, ground water resource characterization, waste lagoons for confined animal feeding operations, and many, many others. What will the year 1999-2000 bring? Come join us and see!

New Publications

- "The Effects of the Chesapeake Bay Impact Crater on the Geologic Framework and Correlation of Hydrogeologic Units of the Lower York-James Peninsula, Virginia" (USGS Professional Paper 1612).

- "USGS Groundwater Flow Model" (USGS Fact Sheet 099-99) describes water supply in the Virginia Coastal Plain and future directions for modeling.

- "Design, Revisions, and Considerations for Continued Use of a Groundwater Flow Model of the Coastal Plain Aquifer in Virginia," (USGS Report 98-4085) is available at: <http://va.water.usgs.gov/>

online_pubs/WRIR/98-4085/randyweb.html.

- "The Potential for Saltwater Intrusion in the Potomac Aquifers of the York-James Peninsula, Virginia," (Water-Resources Investigations Report 98-4187).

- "The Quality of the Nation's Waters, Nutrients and Pesticides," (USGS Circular 1225) provides a national synthesis on the National Water Quality Assessment Program.

- "A Homeowner's Guide to the Development, Maintenance, and Protection of Springs as a Drinking Water Source," from the Virginia Water Resources Research Center at www.vwrrc.vt.edu

Ground Water Protection Steering Committee Website

Do you want to learn more about the Steering Committee's work? Or find web sites with ground water information. Let us know what you think of the site while you're there!

<http://www.deq.state.va.us/gwpssc>

Ground Water Protection Steering Committee Membership

Chesapeake Bay Local Assistance Department (CBLAD) (Web Site: <http://www.cblad.state.va.us>) Contact: Scott Crafton, 804-371-7503

Dept. of Agriculture and Consumer Services (VDACS) (Web site: <http://www.state.va.us/~vdacs/vdacs.htm>) Contact: Sara Pugh, 804-786-3539

Dept. of Business Assistance (DBA) (Web Site: <http://www.dba.state.va.us>) Contact: Dean Bailey, 804-371-8228

Dept. of Conservation and Recreation (DCR) (Web Site: http://www.state.va.us/~dcr/dcr_home.htm) Contact: Rick Hill or Stu Wilson, 804-786-7119

Dept. of Environmental Quality (DEQ), Committee Chair (Web Site: <http://www.deq.state.va.us>) **Ground Water Protection** contact: Mary Ann Massie, 804-698-4042 **Waste Management Issues** contact: Howard Freeland, 804-698-4219

Dept. of General Services, Div. of Consolidated Laboratory Services (DCLS) (Web Site: <http://www.dgs.state.va.us/DCLS/index.htm>) Contact: Ed LeFebvre, 804-786-3767

Virginia Cooperative Extension (VCE) (Web site: <http://www.ext.vt.edu>) Contact: Waldon Kerns, 540-231-5995

Department of Health (VDH) (Web site: <http://www.vdh.state.va.us/>) Contact: Eric Bartsch, 804-786-1760

Department of Mines, Minerals, and Energy (DMME) Web Site: <http://www.mme.state.va.us> Contact: Lynn D. Haynes, 540-523-8179

U.S. Geological Survey (USGS), Water Resources Division (Virginia District's web site: <http://www-va.usgs.gov>; Bureau-wide web site: <http://www.usgs.gov>). Contact: Randy McFarland, 804-278-4750, ext. 267.